

Attorney Docket No.: 027/48221  
PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

SPECIFICATION

**INVENTION:** BRAZED CONDENSER FOR AN AIR CONDITIONER

**INVENTOR:** ~~Kaspar~~ MARTIN KASPAR  
Citizenship: Germany  
Post Office Address/ Kelterstrasse 99  
73733 Esslingen, Germany  
Residence: Esslingen, Germany

**INVENTOR:** Kurt MOLT  
Citizenship: Germany  
Post Office Address/ Ruländerweg 23  
74321 Bietigheim-Bissingen, Germany  
Residence: Bissingen, Germany

**ATTORNEYS:** EVENSON, McKEOWN, EDWARDS & LENAHAAN, P.L.L.C.  
Suite 700  
1200 G Street, N.W  
Washington, D.C. 20005  
Telephone No.: (202) 628-8800  
Facsimile No.: (202) 628-8844

## BRAZED CONDENSER FOR AN AIR CONDITIONER

This application claims the priority of German application 198 48 744.4, filed October 22, 1998, the disclosure of which is expressly incorporated by reference herein.

### BACKGROUND AND SUMMARY OF THE INVENTION

5           The present invention relates to a brazed condenser for an air conditioner, such as a motor vehicle air conditioner, having a block of tubes and fins arranged between two collecting tubes, and with a tube-shaped collector which is mounted laterally on one of the collecting tubes.

10

          In one such condenser known from U.S. Patent 5,159,821, the condenser is assembled and then brazed in a furnace. In order to hold the parts of the condenser together, particularly the collecting tube formed of two half shells, and also to connect  
15       this collecting tube with the tube-shaped collector, molds must be provided to hold the condenser in the preassembled condition until the condenser is brazed.

          It is also known from German Patent Document DE 195 36 999  
20       A1 to hold the two-part collecting tube together with a collector molded of a plane steel sheet bar, as a result of a plastic deformation of elements, such that they can be brazed to one another in a furnace.

5           It is also known from European Patent Documents EP 689 014  
A1 and EP 0 669 506 A1 to provide an extruded tube as a collector  
which is provided on the outside with profile strips extending  
in the longitudinal direction and forming a collecting tube  
together with a half shell. These elements are also joined into  
10 a preassembly and are then brazed in a furnace. Joining must  
take place very carefully, while handling of the condenser during  
transport to the brazing furnace must also be carried out very  
carefully so that the parts do not slide with respect to one  
another; this could impair tight soldering.

15  
          It is an object of the invention to simplify a condenser of  
the initially mentioned type, particularly with respect to the  
design of the collecting tube and the collector, and to ensure  
that these parts are also securely connected with one another  
20 before a brazing in a brazing furnace.

          This object is achieved by prefabricating the collecting  
tube as a one-piece tube which is connected with the collector  
by tack weld seams.

25  
          The use of a one-piece collecting tube is advantageous since  
the tube already has its final shape so that no parts can be  
displaced with respect to one another. Furthermore, tack weld  
seams can be made in a simple manner between the one-piece

5     collecting tube and the collector and provide sufficient  
stability until final brazing-together.

10     In an advantageous further development of the invention,  
the tack weld seams are constructed as laser weld seams. Such  
laser weld seams have the advantage that the introduction of heat  
into the collector and into the collecting tube is relatively low  
so that thermal deformations which may impair subsequent tight  
brazing are not to be expected.

15     In a further development of the invention, at least one of  
the tubes is provided with a plastic deformation for forming a  
contact surface for the other tube. In an advantageous further  
development, at least one connection opening between the two  
tubes is provided in the area of the deformation. Flat contact  
20     in the area of the plastic deformation ensures that the area of  
the connection openings is reliably tightly brazed toward the  
outside.

25     In a first embodiment of the invention, the tube of the  
collector is extended by a coaxial tube piece which is provided  
on the outside with a longitudinal groove forming a contact  
surface for the collecting tube. The use of such a coaxial tube  
piece permits the provision of a secure contact surface. In a  
further development, the coaxial tube piece is provided with an  
30     internal thread for receiving a plug. The coaxial tube piece,

5 therefore, also functions to make a sufficient wall thickness  
available for providing an internal thread for a plug.

Additional characteristics and advantages of the invention  
will be clear from the following description of the embodiments  
10 illustrated in the drawings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is an axial sectional view of a collecting tube and  
a collector of a brazed condenser;

15

Figure 2 is a sectional view along line II-II of Figure 1;

Figure 3 is a sectional view along line III-III of Figure  
1;

20

Figure 4 is a partial axial sectional view of another  
embodiment of a collecting tube and of a collector of a  
condenser; and

25 Figure 5 is a sectional view along line V-V of Figure 4.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

A condenser, which is only partially shown in Figure 1, has  
a collecting tube 10 which is a one-piece, preferably welded  
30 round tube. The collecting tube 10 is provided at regular

5 distances with passages 11 which are used for accommodating flat  
tubes. Normally, so-called corrugated fin plates are arranged  
between the flat tubes. The opposite ends of the flat tubes,  
which are not shown, are fitted into passages of a mirror-  
invertedly arranged collecting tube. On the top and on the  
10 bottom, the collecting tube 10 is closed by closing lids 12 which  
are inserted in a force-locking manner. At defined distances,  
the collecting tube 10 is provided in the axial direction with  
partitions 13. Additional partitions are also assigned (at  
different axial distances) to the opposite collecting tube, which  
15 is not shown. These additional partitions, in connection with  
the partitions 13, cause the refrigerant to flow through the  
condenser in a meandering manner.

The flat tubes, the corrugated fins, the collecting tubes  
20 10, the partitions 13 and the lids 12 are plated with a material  
appropriate for brazing so that they can be brazed to one another  
in a furnace, particularly by way of what is known as the Nocolok  
process. Next to the collecting tube 10, and parallel thereto,  
a collector 14 is arranged which receives a cartridge 15 which  
25 contains dryer granulates and, in addition, acts as a filter  
screen. Between the collecting tube 10 and the collector 14,  
connection openings 16, 17 are provided above and below the  
lowest partition 13. Between the two openings, the cartridge 15  
is provided with a sealing ring 18 resting on the inside against  
30 the collector 14, so that the refrigerant, which is already

5 virtually completely liquified in this area, will necessarily  
flow through the cartridge 15.

The collector 14 is formed by a round tube, such as a welded  
round tube, which is lengthened by means of a tube piece 19 in  
10 the area of its lower end.

In the area of its upper end, the collecting tube 10 is  
provided with a preferably hydraulically made recess 20 which  
extends over a relatively short axial length. This recess is  
15 rounded in a groove-shaped manner so that it forms a contact  
surface for the exterior side of the tube-shaped collector.

The tube piece 19 has a larger outside diameter than the  
welded tube of the collector, onto the lower end of which the  
20 tube piece is pressed by way of a ring shoulder. The tube piece  
19 defines an extruded profile, as illustrated particularly in  
Figure 3. On its exterior side, the tube piece has a  
longitudinal rib 21 which forms a longitudinal groove the outside  
of which is adapted to the outer circumference of the collecting  
25 tube 10. The radial depth of the recess 20 and the radial  
dimension of the tube piece 19 and of the longitudinal rib 21 are  
coordinated with one another such that the collecting tube 10 is  
arranged parallel to the tube-shaped collector, in which case the  
collecting tube rests flatly in the area of the recess 20 and in  
30 the area of the longitudinal rib 21. In this manner, an

5 insulating air gap 29 is left along the predominant length of the collector 14 and the collecting tube 10. As a result, heat transmission from the condenser to the collector 14 is limited so that it is less likely that, because of such heat transport, already liquid refrigerant will be evaporated again in the collector 14. This insulation can still be improved if the air gap 29 is filled with heat-insulating material, such as glass fiber mats.

15 The collecting tube 10 and the collector 14 are placed on one another and aligned in a clamping device. They are then connected with one another by tack weld seams 22, 23 in the area of the recess 20 and in the area of the longitudinal rib 21, which preferably consist of short laser weld seams. Subsequently, the collector 14 and the collecting tube 10 are fixedly connected with one another such that they can easily be removed from the clamping device and transported to a brazing furnace.

25 At its lower end, the tube piece 19 is provided with an internal thread 24 into which a plug 25 is screwed which has a corresponding external thread. The cartridge 15 is locked with this plug 25 so that, after releasing the plug, it can be pulled out of the collector 14 and also does not move upwards during normal operation within the collector 14. The upper end of the collector 14 is closed by a brazed-in closing lid 26. The

5 collector 14 and the tube piece 19 are plated with a material appropriate for brazing like the collecting tube 10 so that tight brazing is achieved in a brazing furnace, particularly in the area of the connection openings 16, 17.

10 In the embodiment according to Figures 4 and 5, the collector 14' has the form of a round tube which is continuous along its whole length and is preferably welded. The collecting tube 10' rests against this round tube of the collector 14' along a surface line. In the areas of the connection openings 16',  
15 17', the collecting tube 10' is provided with a recess 27 which forms a longitudinal groove adapted to the outer contour of the collector 14'. In the area of this groove, the collecting tube 10' and the exterior tube 14' rest flatly against one another. Also in this embodiment, the collecting tube 10' and the  
20 collector 14' are joined in a clamping device and are aligned with respect to one another and are then tack-welded with one another by short laser weld seams. These laser weld seams may be provided at any point because the collecting tube 10' and the collector 14' contact one another along a surface line over the  
25 whole length.

A sleeve 28 is inserted into the lower end of the collector 14' and is later brazed in. The sleeve 28 is provided with an internal thread 24' into which a plug 25 can be screwed by its  
30 external thread.

5           In a modified embodiment, a longitudinal groove is recessed  
into the collecting tube 10' on the side facing away from the  
passages 11, which longitudinal groove is adapted to the outside  
diameter of the tube of the collector 14'. Since, in this case,  
the collector and the collecting tube also rest against one  
10 another, tack welding can also be established here in a simple  
manner by weld seams using laser welding before brazing.

          The foregoing disclosure has been set forth merely to  
illustrate the invention and is not intended to be limiting.  
15 Since modifications of the disclosed embodiments incorporating  
the spirit and substance of the invention may occur to persons  
skilled in the art, the invention should be construed to include  
everything within the scope of the appended claims and  
equivalents thereof.